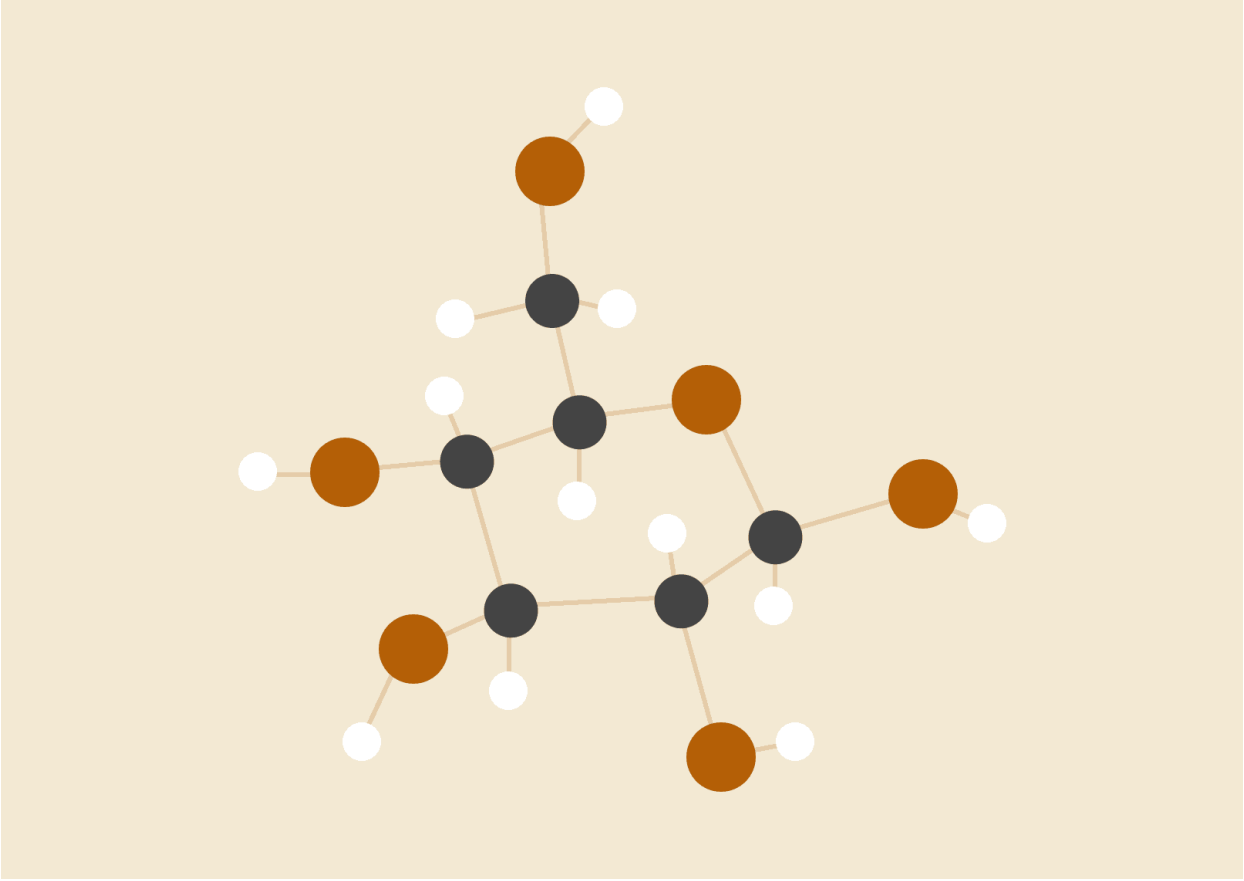
HKSSPC EXTENDED ABSTRACT AND PROPOSAL

How Waste Affects The pH(acidity) of the Ocean



By: Sun Chufeng and Chiu Kung Yee Bernice

ABSTRACT

Our oceans are arguably the single most important thing that sustains life on Earth. Even when looking for signs of life on extraterrestrial planets, oceans and water are the main signs that scientists and researchers are looking for. Needless to say, the ocean's role in sustaining life is an irrefutable and irreplaceable one, yet oceans can't possibly sustain life when the inherent nature of the water is changed. Most ocean-dwelling organisms cannot survive above or below the ocean's pH after a certain level. Therefore, this research proposal aims to find out how waste affects the acidity of oceans.

According to the United States Environmental Protection Agency, prior to the first industrial revolution, the acidity of oceans was at a slightly alkaline level at pH 8.2, whereas now, the pH is at 8.1[1]. While this may look like a miniscule amount of change, in reality it is double the acidity[2]. This change in acidity obviously isn't caused by natural causes as it was unchanged for millions upon millions of years before it. The only other cause would be humans. As production of items ramped up due to the industrial revolution, so did human waste.

INTRODUCTION/LITERATURE REVIEW

Due to this there is significant research done on the issue of waste and its effect on the ocean's acidity. These pieces of research are what we will be basing our own experimentations on. According to a journal on Ocean acidification and how it alters bacterial communities on marine plastic debris, it states that these plastics become a source for unwanted and otherwise non-existent bacteria and other microorganisms. When these life forms respire, they produce carbon dioxide which is acidic in nature and makes the surrounding acidic[3]. While this may be the case for plastics, other wastes are not looked into at the extent of plastic waste. Thus, we aim to create an experiment that can, on a large scale, quantify the damages different types of wastes bring.

RESEARCH DESIGN AND METHODOLOGY

Before we begin our research, it is imperative to define the boundaries of the experiment. As we cannot possibly conduct experiments with all types of waste mankind creates, we will generalize waste into four major categories according to The United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). These types would be municipal solid waste, industrial waste, agricultural waste and hazardous waste. For both simplicity, reliability and accuracy, we will be using three different waste products of each type. The materials needed will be a universal indicator to measure the acidity of the wastes, 1*l* beakers to hold the mixture of waste products and water together, deionised water for experiment to not be affected greatly

The variables needed to be controlled would be the volume of water, the starting acidity of the water, and time taken for the mixture's acidity to be measured as well as the volume of waste.

EXPECTED OUTCOME

It is expected that all plastics will be able to cultivate microorganisms that respire, creating carbon dioxide that makes the water acidic, but might differ in the amount and speed. However, not all plastics do not break down fast enough for the acidic components to dissolve into the water, thus, there might be various results depending on the type of plastic that is being used. We expect that Acrylic methacrylate which contains methacrylic acid that is derived from acrylic acid, can make the water more acidic compared to other types. This is because the plastic can both break down into its acidic components and also cultivate microorganisms which produce CO2 that makes the water more acidic. Thus, this combination creates the maximum acidification of the water.

REFERENCES

1. https://www.epa.gov/ocean-acidification/understanding-science-ocean-and-coastal-acidification#:~:text=Prior%20to%20the%20Industrial%20Revolution,ten%2Dfold%20increase%20in%20acidity.
2. https://energyeducation.ca/encyclopedia/The_pH_scale
3. https://www.sciencedirect.com/science/article/abs/pii/S0025326X20308675?via%3Dihub